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THE RESTORATION OF MAIN TURBINE BARRING GEAR STOPPAGE ISSUE IN THERMAL POWER STATION

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ABSTRACT

Barring gear (or "turning gear") is the mechanism providing to rotate the Turbine Generator shaft at a very low speed after unit stoppages. Once the unit is "tripped" (i.e., the steam inlet valve is closing), the turbine coasts down from 3000 rpm to Barring Gear speed of 75-80 rpm and runs at Barring Gear speed until next rolling or towards standstill after sufficient cooling of Turbine casing.

There are two cases of particularly which this condition must be filled. However it is always true that turbine should be on barring gear.

CASE 1: COLD START (TURBINE STARTING IN COLD CONDITION)

Rotor is big enough in length and is supported at two bearings at extreme ends. It acts like simply supported beam. Rotor is bound to sag in this condition and if it is rolled at higher rpm in this condition, turbine will encounter with high vibration. To remove this sagging it is must that turbine must be on barring gear before rolling that too at least 8 hours.

CASE 2: HOT START UP TURBINE STARTING IN HOT CONDITION)

When turbine has tripped and again started within 6 hours. In this condition top casing is generally hotter than bottom casing as hot air tends to move up due to less density. If turbine is not rolled on barring gear, the upper part of rotor will be subjected to higher temperature that the lower part of it. By rolling shaft at slower rpm, it is ensured that no uneven expansion happens.

Any issue in Turning of Barring Gear results in halting of Turbine Generator shaft until HP Turbine Shaft Temperature reaches 100 Deg C, which usually takes 4-5 Days and thus results in loss of Generation.

KEYWORDS: Turbine Generator & Thermal Power Station

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INTRODUCTION

In internet, we might come across surmounting amount of topic on the abrupt stoppage of Main Turbine Barring Gear (Turning Gear) Researchers are still working on it to nullify this issue by altering Turbine design geometry and changing the manufacturing materials. This project is a similar one and few literature studies related to our project are given in this chapter.

A. Mr.RANGA REDDY, Executive President M/s.BHEL & Mr.RAVI REDDY,General Manager M/s.BHEL conducted case study in “Abrupt Stoppage of Turbine Rotor, running on Barring after Major Overhauling” which is detailed below.

This case study is about a typical experience where a steam turbine, which was running at 100 RPM on barring (turning) after overhaul, stopped abruptly and the rotor was found to be seized.

The case study is about this incident and the external factors influencing the turbine rotor seizure, from 100 RPM to zero RPM in less than 5 seconds, its root cause and the rectification activities.

Inadequately installed turbine casing thermal insulation can cause a serious incident like rotor seizure.

Turbine thermal insulation should be maintained as per specification.

Turbine thermal insulation should be a major item in the major overhauling & safe maintenance procedure check list. Uneven temperature of turbine casing due to inadequately installed insulation can cause damage to the turbine rotor and casing internals (involving long down time & cost)

B. Jyoti K. Sinha, W. Hahn, K. Elbhbah, Kelechi G. Obi-MgbamDynamics Laboratory, School of MACE, The University of Manchester M13 9PL UK Coal, Gas and Renewables, EDF Energy, Barn wood UK had conducted case study in “Vibration of a Steam Turbo-Generator (TG) Set during Shutdown Period” & related Barring Speed disturbance which are detailed below.

The steam turbo-generator (TG) sets in power plants during the shutdown period often operate at a very low speed with the aid of barring gear. This low speed is known as the barring speed and it is of the order upto100RPM. The purpose is to float the rotor in the fluid bearings so that the rotor heavy self-weight should not cause any damage to the bearings. The barring speed also maintains uniformity of temperature across the complete rotor when cooling down from operating condition to normal condition. Operating at the barring speed is often considered as the machine is close to the stand still condition and may not be subjected to any harsh vibration problem. However the in-situ vibration measurement on a typical steam TG set during machine shutdown operating at the barring speed reveals that the machine is subjected to vibration which may have potential to propagate the existing damage further. The paper presents a typical industrial case study and observations.

The operation of JOP always causing resonance of the LP last stage blades even during shutdown condition which has potential to initiate the crack in the exiting notch that can further propagate with time. This machine has already seen the LP last stage blade failure. Therefore the contribution to the blade failure even during the TG shutdown condition cannot be ignored. Hence it is important to conduct the vibration measurement and analysis of such TG sets even during shutdown condition when operating at the barring speed to eliminate the likely problems.

TURBINE

The turbine is a tandem compound machine with separate HP, IP and two LP sections. The HP section being a single-flow cylinder and the IP and LP sections double-flow cylinders. The turbine rotors and the generator rotor are connected by rigid couplings. The HP turbine is throttle controlling with one extraction. The initial steam is admitting ahead of the blading via two main stop and control valve combinations. A swing check valve is installing in the line leading from HP turbine exhaust to the Reheater to prevent hot steam from the reheater flowing back into the HP turbine.

The steam coming from the Reheater is passing to the IP turbine via two reheat stop and control valve combinations. Cross around pipes connects the IP and LP cylinders. Connections are providing at several points of the turbine for feed water extraction purpose.

HP Turbine, Barrel Type Casing

The outer casing of the HP turbine is of the barrel type and has neither an axial nor a radial flange. This prevents mass concentration which would have causing high thermal stresses. The almost perfect asymmetric design of the casing permits moderate and nearly uniform wall thickness at all sections. The inner casing is axially split and supporting so as to be free to move in response to thermal expansion. As only slight pressure differences are effective, the horizontal flange and joint bolts of the inner casing can be kept small. The barrel type casing permits flexibility of operation in the form of short start-up times and a high rate of change of load even at high initial steam conditions. [1]

IP Turbine

The IP turbine section is of double flow construction with horizontally split casings. Allowance is made for thermal movement of the inner casing within the outer casing. The inner casing carries the stationary blading. The reheating steam enters the inner casing from top and bottom. The provision of an inner casing confines high steam inlet conditions to the admission section of this casing, while the joint flange of the outer casing is subjecting only to the lower pressure and temperature effective at the exhaust from the inner casing. [1]

LP Turbine

The casing of the double-flow LP cylinder is of three-shell design. The shells are horizontally split and are of rigid welding construction. The innermost shell, which carries the first rows of stationary blades, is supporting so as to allow thermal expansion within the intermediate shell. The intermediate shell rests at four points on longitudinal girders, independent of the outer shell. Guide blade carriers, carrying the last Stationary blade rows are also attaching to the intermediate shell. [1]

Blading

The entire turbine is providing with reaction blading. The stationary and moving blades of the HP and IP sections and the front rows of the LP turbine are designing with integrally milling inverting T -roots and shrouds. The last stages of the LP turbine are fitting with twisting drop -forging moving blades with fir-tree roots engaging in grooves in the shaft with last stage stationary blades made from sheet steel. [1]

Bearings

The HP rotor is supporting on two bearings, a journal bearing at its front end, and a combining journal and thrust bearing immediately next to the coupling to the IP rotor. The IP and LP rotors have a journal bearing each at the rear end. The combining journal and thrust bearing incorporates a journal bearing and a thrust bearing which takes up residual thrust from both directions. The bearing metal temperatures are measuring by thermocouples directly under the babbit lining. The temperature of the thrust bearing is measuring in two opposite thrust pads. The bearing pedestals are anchoring to the foundation by means of anchor bolts and are fixing in position.

The HP and IP turbines rest with their lateral support horns on the bearing pedestals at the turbine centerline level. The HP and IP casings are connecting with the bearing pedestals by casing guides, which establish the centerline alignment of the turbine casing. The axial position of the HP and IP casings is fixing at the support brackets on HP-IP bearing pedestal. The fixing point for the LP casing is at the front point of support on the longitudinal girder. Thermal expansion of the casings originates from the fixing points. [1]

Shaft Seal and Blade Tip Sealing

All shaft seals, which seal the steam in the casings against the atmosphere, are axial-flow type. They consist of a large number of thin seal strips which, in the HP and IP turbines are caulking alternately into grooves in the shafts and the surrounding seal rings. In the LP turbine, the seal strips are caulking only into the seal rings. Seal strips of similar design are also using to seal the radial blade tip clearances. [1]

Valves

The HP turbine is fitting with two main stop and control valves. One main stop valve and one control valve with stems arranging at right angles to each other are combining in a common body. The main stop valves are spring-action single-seat valves; the control valves, also of single-seat design, have diffusers to reduce pressure losses. These valve combinations are locating at both sides of the turbine with their stems horizontal. The HP valves are connecting to the turbine by easily separable collar couplings, which contain self-sealing U-rings as sealing elements. The IP turbine has two reheat stop and control valves. The reheat stop valves are spring-action single-seat valves. The control valves, also spring-loading, have diffusers. The control valves operate in parallel and are fully open in the upper load range. In the lower load range, they control the steam flow to the IP turbine and ensure stable operation even when the turbine-generator unit is supplying only the station load. The reheat stop and control valves are supporting free to move in response to thermal expansion on the foundation cover plate below the operating floor and in front of the turbine-generator unit. All valves are actuating by individual hydraulic servomotors. [1]

Turbine Control System

The turbine has an electro hydraulic control system. An electric system measures speed and output and controls them by operating the control valves hydraulically via an electro hydraulic converter. The electro hydraulic controller ensures controlling acceleration of the turbine-generator up to rating speed and limits speed overshoot in the event of sudden load rejection. The linear power frequency droop characteristic can be adjusting in fine steps even when the turbine is running. [1]

Turbine Monitoring System

In addition to measuring and display instruments for pressure, temperatures, valve lifts and speed, the monitoring system also includes instruments for measuring and indicating the following parameters:

- Rotor expansion measuring at the rear-bearing pedestal of the LP turbine
- Axial shift measuring at the HP-IP pedestal
- Bearing pedestal vibration, measuring at all turbine bearings
- Shaft vibration measuring at all turbine bearings [1]

Oil Supply System

A common oil supply system lubricates and cools the bearings. The main oil pump is driven by the turbine shaft and draws oil from the main oil tank. Auxiliary oil pumps maintain the oil supply on start-up and shutdown, during turning gear operation and when the main oil pump is faulting. DC Emergency oil pump supplies oil to the bearings during AC power failures.

A Jacking oil pump forces high-pressure oil under the shaft journals to prevent boundary lubrication during turning gear operation. The Jacking oil pump also supplies the high pressure oil to the Hydraulic Turning gear motor. The lubricating and cooling oil is passing through oil coolers before entering the bearings. The control fluid pumps situating on a control fluid tank supply the hydraulic turbine and bypass control system and the protective devices and valve actuators with HP and LP control fluid. [1]

BARRING GEAR STOPPAGE ISSUE

In a 600 MW Unit, critical issue of Main Turbine barring gear stoppages are experiencing from the date of commissioning. Non-engagement of barring gear results in abrupt stoppage of rotor and engagement of barring gear happens only when the HP shaft temperature comes down to 250 Deg C, Which takes about 3 to 4 days. In-spite of carrying out various corrections and Settings suggesting by OEM and maintaining various operation procedures and parameters suggesting by OEM during unit tripping, the jamming of barring gear is still persisting in 600 MW Unit . Further the generation loss and other technical problem also arises due to Main Turbine barring gear stoppages.

BASING ON CASE STUDY WORKS PROPOSED FOR RESTORATION OF MAIN TURBINE BARRING GEAR STOPPAGE ISSUE

Pedestal *Dismantling*

- Removal of insulation of HP & IP modules.
- Dismantling of acoustic noise enclosure to facilitate movement of dismantling components.
- Opening of Pedestal covers of pedestal No.1, 2, 3, 4 & 5.
- C&I probes removal and yokes removal and bearing top halves removal for all bearings.
- CRO checks for LP-Generator, HP-IP, IP-LP1, LP1-LP2 rotors.
- HP front swing check with HP-IP & IP-LP1 coupling condition and LP1-LP2 coupling in de-coupling condition measuring ad recording.
- De-coupling of LP-Generator, HP-IP,IP-LP1, LP1-LP2 and HP-MOP rotor’s couplings.
- Exciter rotor swing check.
- CRO check and decoupling of generator exciter rotors.
- Dismantling of MOP.
- Dismantling of HP front sub-shaft and turning wheel.
- Alignment of HP-IP, IP-LP1, LP1-LP2, LP-Generator and Gen-exciter couplings measuring and recording.

- Check and record of pedestal Seal bore and turbine reference readings.

Hp Turbine

Dismantling

- Platform preparation at the bottom of HP casing for pipeline cutting, key removal etc.,
- Cutting of HPT front and rear gland pipelines.
- Loosening of HPT exhaust pipe line flange bolts.
- Cutting of HP extraction pipeline (2 No's).
- Locking of valve assembly with supports for loosening of breech nuts.
- HPT inlet breech nuts loosening by torch heating.
- HPT inlet breech nut found seizing after loosening for 7 threads (Left & Right).
- Further, breech nut was heating by coil heating and rotating with "C" spanner device.
- Both the breech nuts were successfully loosening.
- HPT roll and bump check and recording.
- Locking of HP rotor with casing.
- Removal of all radial and axial keys of HP module.
- Assembly of loading fixtures in the service bay.
- Lifting and shifting of HPT to service bay.
- Leveling of HP module at dismantling fixtures, removal of HP rear glandsealsafterrecording seal clearances.
- Removal of extraction inserts.
- Removal of gland inserts of HPT .
- HPT roll & bump check was recording in fully assembling condition in service bay.
- HP rear gland housing (T/H & B/H) removal.
- Vertical positioning of HP module in dismantling fixture.
- Removal of locking ring, segments and radial keys of inner-casing. Locking grubscrews and dowel pins of locking ring were seizing and the same were drilling and removing.
- HP inner casing removing from outer casing and horizontally placing on the stands.
- HP inner casing roll and bump check.
- Loosening of HP inner casing P/P bolts by induction heating.
- Removal of HP inner casing T/H carrying out.

- Steam Flow path measurement of HP turbine.
- HP rotor removal from inner casing and shifting for alumina blast cleaning.
- Removal of seal segments from HP inner casing.

Figure 1

Revisioning

- Alumina blast cleaning of HP rotor and casings.
- Carry out inspection of HP turbine after dismantling and suggesting rectification measures.
- Centering of HP inner casing w.r.t outer casing was checking and no major deviations observation. Minor deviations correction.
- New keys at the front and rear sides of the inner casing was assembling.
- HPT inner casing top & bottom assembling. P/P gap and ovality of the inner casing recording and found within allowable limits.
- Dimensional checks for HPT inlet and exhaust ‘U’ seal rings after thorough cleaning.
- Nos. of HPT main steam inlet “U” seal rings were machining to requiring dimensions andassembling.
- Face run-out of HP rotor rear coupling face was recording with rotor placing in No – 1 & 2bearings.
- Locking blades of HP rotor if found to be projecting outside and the same should be dressing up.
- Re-finning of sealing fins.
- Temporary boxing up of inner casing is carrying out and ensuring requiring design clearances.
- DPT of HPT inlet and exhaust ‘U’ seal rings and found OK.
- DPT of inner casing, extraction “U” seal rings, Outer gland “U” seal rings.
- DPT of inner casing fasteners.
- Thorough cleaning of HPT inlet sealing area and breech nut threads.
- HP outer casing thorough cleaning of ’U seal ring area, ‘I’ seal ring and its area, key waysand top gland flange area carrying out.[2]

Figure 2

Figure 3

Re-Assembly

- HPT seals butt clearances recording.
- Front and rear roller supports for rotor assembling.
- HP rotor placing in inner casing B/H.
- Steam Flow path clearances recording and ensuring within design limits.
- HPT Inner casing top half assembling
- P/P bolts tightening and initial readings for bolt elongation were recording.
- P/P bolts hot tightening carrying out and P/P studs elongation values recording.
- Inner casing Roll and bump checks.
- Locking arrangement for inner casing to rotor.
- Inner casing placing in outer casing.
- Segment ring and locking ring assembling in position.
- New dowel pins and locking grub screws for HPT locking ring were assembling.
- Inner casing elevation w.r.t outer casing recording and ‘U’ seal compression recording
- HP module horizontal positioning carrying out.

- Assembly of extraction inserts.
- Assembly of HP gland inserts.
- HP rear gland housing was centering, seal clearances were ensuring and boxing up.
- HPT final roll and bump check was measuring in fully assembling condition and recording.
- Transportation fixture assembling and locking of HP rotor w.r.t casing.
- Shifting of HPT from service bay and placing in its position on TG pedestals.
- Load shifting of HPT rotor from locking devices to bearing no.1 and 2.
- Loading of HP casing on loading packers.
- HPT inlet & exhaust pipe lines assembly.
- Tightening of HPT extraction & exhaust flange bolts by induction heating.
- Hot tightening of HPT inlet breech nuts by torch heating.
- Assembly and welding of HPT drain and leak-off pipe lines.
- Welding of extraction pipelines. NDT tests as per FWS.

IP Turbine

Dismantling

- Dismantling of IPT gland leak off lines .
- Centering of rotor w.r.t outer casing was recording.
- Horn drop of IP casing was recording.
- Loosening of IPT inlet pipe lines joint bolts .
- Dismantling of IPT gland steam pipe lines .
- Roll check and bump check of IPT.
- Removal of extraction pipelines of IPT.
- IPT outer casing P/P bolts loosening.
- Removal of IPT outer casing top half.
- IPT inner casing P/P bolts loosing and Casing removing from position.
- IPT steam flow path clearances recording.
- IPT rotor lifting from position.
- Removal of IPT Bottom half inner casing.
- All the thermocouples connecting to IP inner casing found to be cut.

Figure 4

Revisioning

- Alumina blast cleaning of IPT rotor, inner casings.
- Record of IP rotor front and rear coupling face run out & natural run out.
- Thorough cleaning of Angle rings, outer casing Parting planes.
- IPT inner casing assembling for ovality check
- Check and record of IPT inner casing ovality with cold condition and hot tightening condition (hot tightening done by induction heating method).
- Revisioning of IPT outer casing front gland seal segments.
- Temporary boxing up of IP inner casing without shaft seals and P/P bolts hot tightening.
- Ensuring minimum radial clearances of blade section of IP inner casing.[2]

Re-Assembly

- IPT inner casing B/H thermocouple assembly.
- IPT inner casing B/H assembly in position.
- IPT rotor placing in inner casing B/H.
- Check and record of IPT steam flow path clearances.
- IPT inner casing top half assembling in position.
- IPT inner casing P/P studs length in cold condition was recording.
- Hot tightening of IPT inner casing P/P bolts by induction heating carrying out.
- IP inner casing P/P bolts elongation values Checking & recording.
- Recording of IPT outer casing front gland seals flow path clearances.
- IPT inner casing roll, bump check.
- Centering of inner casing w.r.t outer casing was measuring, correcting and recording.

- Thermal clearances of holding down bolts & thermal washers ensuring.
- IPT outer casing assembling in position.
- IPT outer casing P/P studs length in cold condition was recording.
- Hot tightening of IPT outer casing P/P bolts by induction heating method.
- IP outer casing P/P bolts elongation values checking& recording.
- IPT inlet flange bolts assembling in position. Hot tightening of bolts carrying out by inductionheating. Ensuring the stud elongation values
- IP extraction pipelines assembly.

Lp1 & Lp2 Turbine Overhaul

Lpt - Dismantling

- LPT outer casing lifting from position.
- Roll check of LP inner-outer casing and values were recording.
- Dismantling of LPT inner-outer casings.
- Dummy plates from LP inner-inner casing were dismantling.
- LP inner-inner casing p/p bolts loosening and top half casing dismantling from position.
- Flow path clearances of LP turbine was measuring and recording.
- LPT rotor along with expansion bellows lifting from position.
- LP expansion bellows removing and LP rotor placing on stands.
- Removal of gland seal segments from LP glands.

Figure 5

Lpt - Revisioning

- Alumina blast cleaning of LPT rotor, inner-inner casing (T/H), inner-outer casing (T/H) carrying out.
- LP rotor free standing blades (last stage – 3L & 3R) are removing for NFT and MPI.
- Thorough cleaning of LPT blades and rotor root area.
- MPI testing of free standing blades.
- NFT of rotor free standing blades. Allthe measuring values should be within acceptable limits.
- LPT inner –inner casing P/P gap check and ovality check.
- Thorough cleaning of LPT bottom half casings P/P.
- Thorough cleaning of LPT inner-outer casing top half parting plane and fixing blades carrying out.
- Revisioning of LP Front and Rear gland seal segments.
- Cleaning of LPT outer casing.
- Platforms were made for inspection of LP extraction bellows.
- Cleaning and DPT of rotor bellows and extraction bellows.If Cracks were
- Observing in LPT extraction bellows joint area and the same to be repairing.
- DPT should be done after repairing.
- Face run out of front and rear coupling faces of LP rotors was recording.[2]

Lpt - Re-Assembly

- Checking and recording of LPT steam flow path clearances.
- LPT inner-inner casing top half assembling in position.
- Cold tightening of P/P bolts. Initial lengths recording.
- Hot tightening of P/P bolts.
- LPT inner-inner casing P/P bolts elongation values recording.
- Locking of all inner casing fasteners carrying out.
- LPT inner-inner casing dummy plates assembling.
- Assembly of LPT inner-inner casing thermal washers.
- LPT inner-outer casing assembling in position and its P/P bolts tightening.
- LPT roll check and loading packers correcting with desiring offset.
- LPT radial keys assembling with desiring clearances.
- LP casing radial keys locking was ensuring.

- Platform inside the LP turbine removing.
- Assembly of LPT outer casing.
- Assembly and Centering of LPT glands carrying out with desiring offset.

Bearings and Oil Guards and Mop

Bearings and Oil Guards Revisioning

- Bearing No 1, 2, 3, 4, 5 torus to support blue contact matching checking, correcting andensuring.
- Bearing No.2 thrust pads dimensional check and corrections.
- Bearing No.2 thrust pads blue contact matching with surface plate.
- Bedding check of bearing no. 1, 2, 3, 4, 5, 6, 7 & 8 with rotor journals.
- DPT and UT of bearings (1 to 8) and thrust pads and found OK.
- Dimensional check and record for bearing no.1 to 8 and corresponding journals.
- All the JOP hoses were replacing with new spares.
- Pedestal front oil guards refining.
- Oil guards machining at work shop.
- Oil guards were assembling in position with desiring clearances.[2]

Figure 6

Main Oil Pump Revisioning

- Thrust float of MOP checking and found OK.
- MOP was completely dismantling.
- DPT of bearings, oil wear rings, MOP impeller and governing impeller.
- Crack was observing in MOP thrust bearing during DPT and same was replacing with newbearing machining to desiring clearances.[2]

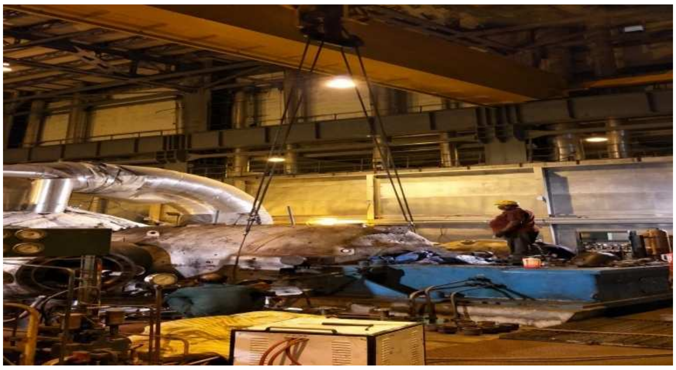

Figure 7

Valves and Strainers

Steam Strainers

- Insulation was removing from strainers 4 nos. (MS strainers-2 nos, HRH strainers --- 2 nos).
- Dismantling and inspection of MS and HRH strainers.
- One No's of thermo well were recovering from MS strainer (Right) after dismantling. Also aminor damage was noticing.
- Steam strainer element of HRH strainer – RHS replacing with new element.
- Strainers were assembling with new gaskets.
- Hot tightening of strainer dummy plate after steam charging.

Valves and Servomotors

- Insulation was removing from valves.
- Oil line connections were removing.
- HP Stop valves & Control valves along with its servomotors were removing from position.
- HPCV (RHS) control valve check nut could not be loosening. Hence it is removing bygouging.
- Leakages were observing in HPSV servomotors. Hence servomotors were dismantling, "O"rings& gland bush were replacing. Boxing up of HPSV servomotors.
- After dismantling, it was observing that the spindle of HPSV(Right) was bent near thecoupling end. The same was replacing with new spindle.
- After thorough cleaning and inspection, valves were boxing up.
- Dents in the valve seat area of HPCV (Left & Right) removal.
- Blue contact of valve seating area was ensuring.
- . Stop and control valves of HPT were assembling in position.
- HPT Stop and control valves servomotors were assembling in position.

- Servomotors oil lines were connecting.
- After charging of governing rack, valve travel was checking and found ok.
- Valve travel was set as per governing characteristics.[3]

Final Assembly

- Final alignment and correction for HP-IP and IP-LP1, LP1-LP2 and LP2-Generator andgenerator-exciter rotors.
- Bump check of HP & IP was measuring and recording.
- HP-IP, IP-LP1, LP1-LP2 rotors were coupling and coupling bolts stretching and CROmeasurements found to be within limits.
- Roll check of HPT and IPT checking, correcting and ensuring with requiring offset. Centeringof HPT & IPT recording.
- Cleaning of Bearing no.1, 2 3, 4 & 5 pedestal.
- Thrust pads assembly of bearing no.2 and box up.
- Box up of Bearing no.1 to 5.
- Oil deflector assembly for bearings all bearings.
- Alignment and correction of HP-MOP coupling.
- Yoke assembly for Brg no.1,2 3,4 & 5.
- Bottom oil guards assembly for pedestal 1,2 3,4 & 5.
- Bearing no.6 and 7 box up.
- TG rotor thrust float checking and recording.
- Clearances at over-speed trip devices were measuring and recording.
- TG rotor kept in zero position.
- Bearing pedestals C&I works.
- All bearing pedestals boxing up.
- Oil flushing by introduction of line filters in lubrication oil inlet and cloth
- Installing in bucket filter of MOT.
- Oil flushing to satisfactory extent and lubrication oil system was
- Normalizing.
- TG rotors JOP lifts checking and adjusting.
- Machine put on barring gear.[3]

Figure 8

Commissioning

- Rolling Machine successfully 3000 rpm.
- Shaft vibration at bearing 2, if found to be in higher side. Trim balancing atIP front and vibration level will bring well within alarm limits.
- A balancing weight (for example of 636 grams (12* 53g – XCN 36) in 250o Counter Clockwise direction) might be added at IPT front plane.
- After balancing, machine could be synchronized to grid. [3]

CONCLUSIONS

Abrupt stoppage of Main Turbine Barring Gear in each Turbine Tripping might be resolving by adopting above proposed works which saves 4-5 days of generation loss in every Turbine Tripping.

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